Pequi Oil

BERACA

INCI Name: *Caryocar brasiliense fruit oil, Tocopherol*

RAIN FOREST SPECIALTIES BRASIL

Refined oil

Proven efficacy

The pequi tree is native to Brazil's tropical savannah biome (also known as "Cerrado") and can be found throughout the country's Midwest. Locally known as "Cerrado's Gold", pequi offers a unique combination of biochemical compounds that are sustainably extracted by Beraca.

Pequi Oil has a high concentration of provitamin A and is naturally rich in oleic and palmitic fatty acids. Such features make the Pequi Oil a perfect choice for use in skin and hair care formulations. The efficacy and benefits of the Pequi Oil in products for curly hair have been proven by independent laboratory tests.

Efficacy Test

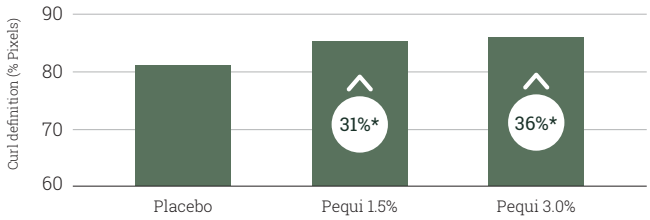
Image analysis lab tests have been conducted to assess curl definition and frizz reduction in hair strands treated with Pequi Oil. Testing was performed under controlled temperature and humidity conditions.

The study used 15 naturally wavy Caucasian hair strands, each weighing 5g and measuring 25cm. All strands underwent a standard pre-wash procedure using a solution containing 10% of Sodium Lauryl Ether Sulfate (SLES), followed by rinsing in running water for one minute.

0.5ml of the tested product was then applied to each hair strand and massaged for 60 seconds. The samples were left to dry naturally for 24 hours without combing or rinsing.

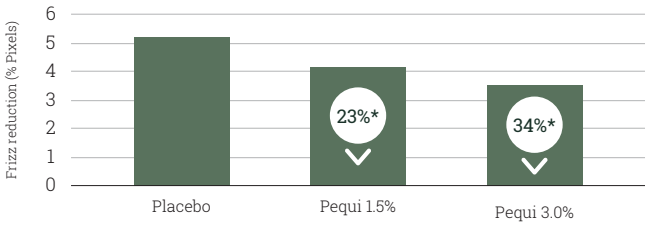
The tested parameters – curl definition and frizz reduction – were assessed using pixel analysis software and the results are described in the tables below.

Curl Retention



* Statistical significance p<0.05 when compared to placebo
** Hair strands treated after 24 hours

Frizz Reduction



* Statistical significance p<0.05 when compared to placebo
** Hair strands treated after 24 hours

Fatty Acid Composition

Palmitic Acid (C16:0)	**25.0 – 55.0%**
Palmitoleic Acid (C16:1)	≤ 6.0%
Stearic Acid (C18:0)	≤ 3.0%
Oleic Acid (C18:1)	**35.0 – 65.0%**
Linoleic Acid (C18:2)	0.5 – 10.0%
Linolenic Acid (C18:3)	≤ 2.0%

Images of hair strands in test groups

Placebo | Pequi 1.5% | Pequi 3.0%

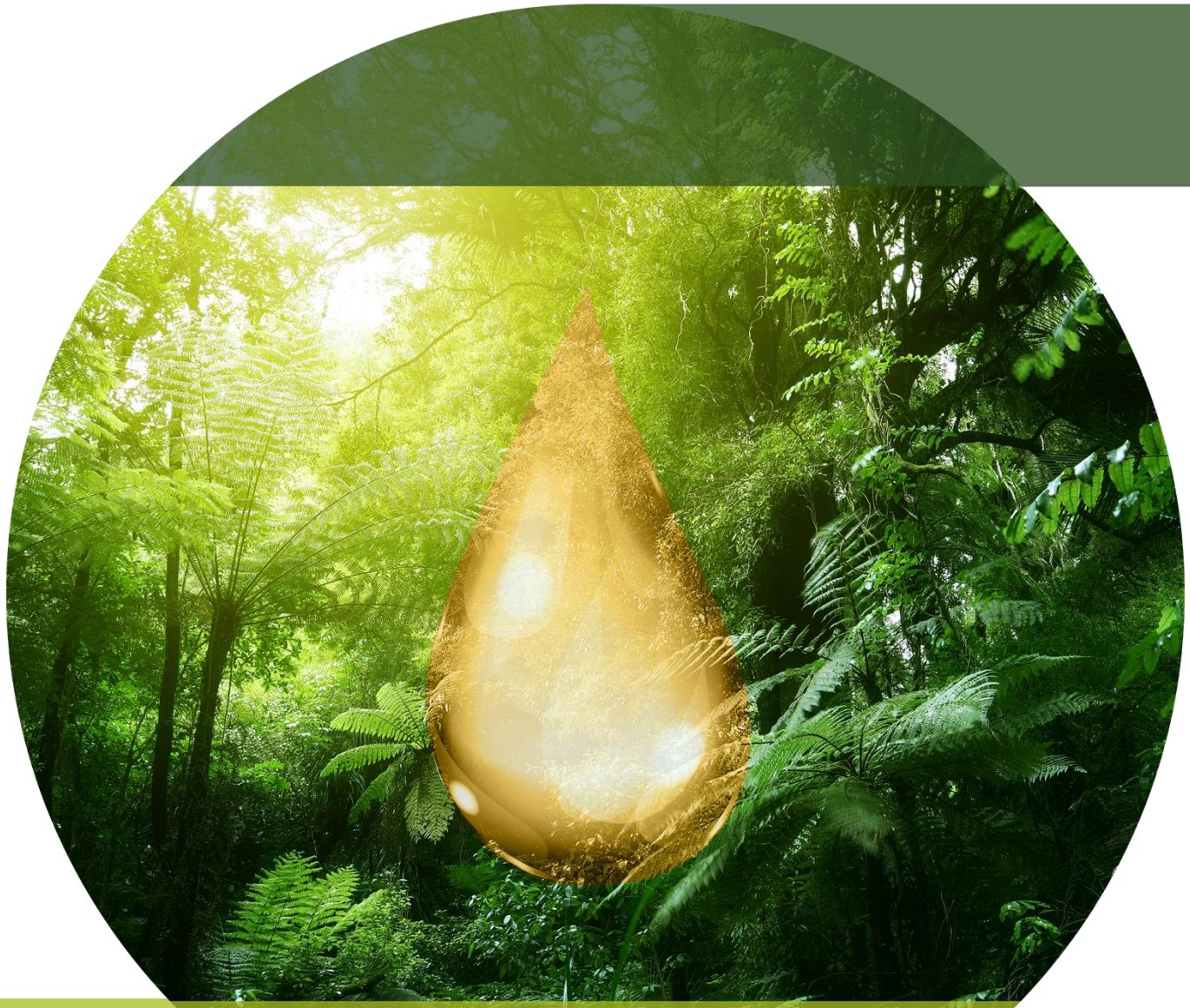
Indication

The refined Pequi Oil is suitable for use in formulations for shampoos, conditioners, leave-on serums, low-poo and co-wash products.

Properties

- Anti-frizz action;
- High concentration of oleic and palmitic acids;
- Defines and keeps curls under control;
- Source of provitamin A;
- Strong emollient potential.

BERACA



TECHNICAL DATA SHEET:
PEQUI OIL

BERACA presents a wide portfolio composed of fixed oils, butters, scrubs, clays and actives sustainably sourced from the Brazilian biodiversity. The ingredients sold by the company are directly related to the work developed by extractive communities throughout Brazil. Through the Socio-Biodiversity Enhancement Program®, the company connects biodiversity to thousands of consumers around the world. This means, among other advantages for our stakeholders, transparency, traceability and innovation, which directly contribute to regional development and environmental preservation of different biomes in the country.

GENERAL INFORMATION

The species *Caryocar brasiliense,* is a member of the Caryocaraceae family; it is a Brazil native plant, popularly known as pequi, piqui, piquiá, piqui-do-cerrado, piquiá bravo, pequerim, amêndoa-de-espinho, grão-de-cavalo and suari. It reaches 6 to 10 meter-high, with a 30 to 40 cm diameter-winding trunk, and three-foliolate composed leaves, with pubescent leaflets. It occurs in the States of São Paulo, Minas Gerais, Mato Grosso do Sul, Goiás, and Mato Grosso, in the cerrado region.

Its fruits are edible and valued within the Brazilian culture: its stone and pulp are cooked for culinary purposes, used to prepare a liqueur, or for the extraction of butter and sebum; the stone is ligneous and formed by a great amount of small thorns. In addition, fruits are eaten by several species of the local wild fauna what contributes for the species dissemination.

The pequi tree has features of a heliophyte, semideciduous, selective xerophyte plant, tipical of cerrado regions, also in primary, secondary, and pioneer formations, and its grouping occurrence is somewhat dense.

It is a perennial plant with florescence occuring between September and November, and fruits seasoning occurs by the middle of November, and fruits may be found up to February. The pequi fruit is drupoid, green, globous, with a leathery-fleshy epicarp, and a grey or green-yellowish bark, a light-yellow, fleshy, fragrant, and tannin-rich pulp, and its endocarp (stone wrap) is covered by a thin and rigid 2-5 mm-long thorns layer.

Seeds are reniform, white, with two to four seeds by fruit, wrapped by a fleshy yellowish mesocarp. The fruits size variers from 6 to 14 cm, weighting from 100 to 300 g.

PROPERTIES

Pequi Oil acts as an emollient, rich in oleic and palmitic acids, which are fatty acids very similar to those found in the epidermis, besides presenting an important concentration of provitamin A. It promotes a pleasant touch, softness and hydration, due to the film formed by it active. These features make this oil an ideal element for the development of cosmetic formulations for skin and hair.

COSMETIC USE

• Hair products for all hair types, especially those for curly hair (shampoos, conditioners, masks, combing creams, ampoules, pomades, finishers, low-poo products, co-wash, etc.);
• Body and facial products for all skin types (emulsions, lotions, liquid and bar soaps, shower gel, oils, massage oils, etc.);
• Sunscreens and after sun;
• Makeups in general;

• Men's products (aftershave, shaving cream, etc.).

EFFICACY EVALUATION

INTRODUCTION

Hair is a natural fiber formed by keratin and, according to its geometry and physical structure, it presents several features, as elasticity, smothness, volume, combability, and brightness. Its structure is formed by:

- Cuticle: upmost external layer containig a high level of cystein, that acts as a protector of the internal layer, the cortex;
- Cortex: part of the hair fiber with most of the hair mass, formed by very thin fibers, and granules of melanin that defines both threads color and photoprotection, according to its amount. Processes as straightening, permanent, and dyeing occur on this hair layer;
- Medule: central region of the fiber that may be discontinuous or even absent in some hair types.

Figure 1 shows a schematic representation of the hair fiber, with its layers.

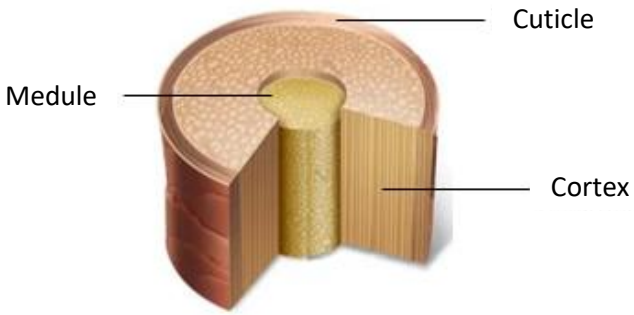


Figure 1. Schematic representation of a hair fiber.

Brazil is the country with the largest variety of hair types and the country is one of the greatest haircare products market of the world. This variety defines hair types as straight, wavy, curly, and kinky.

Wavy hair, very common among Brazilian women, demands special care. A common care to be applied is the **frequent hydration**, since the curve of these threads makes difficult that the natural oiliness may cover the whole length, drying the trheads, mainly in their extremities. Thus, hydration is fundamental to develop the natural threads smoothness and brightness, in order to make easy the waves modelling process.

Knowing these pieces of information, Beraca went to search in the nature a solution with proven efficacy, able to care of curly hair, defining threads, making easier the combability, and reducing the frizz: the PEQUI OIL.

OBJECTIVE

This study purpose was evaluating, through images analyses, hair waves definition and the frizz reduction in hair strands that undergone a PEQUI OIL- containing treatment.

METHODS

1. **Laboratory**

The study was carried out in an independente laboratory, Kosmoscience Ciência & Tecnologia Cosmética Ltda. Study reference Nr: RE-BC041-16-R0.

2. **Experimental and Treatment Groups**

Experimental groups and their respective treatments are reported in Table 1.

Table 1. Products used in the study protocol.

Experimental group	Treatment
PLACEBO	Finisher cream with no PEQUI OIL
PEQUI OIL at 1.5%	Finisher cream with PEQUI OIL at 1.5%
PEQUI OIL at 3.0%	Finisher cream with PEQUI OIL at 3.0%

All products were stored under room temperature during the study period.

3. **Protocol procedure**

3.1. Hair strands preparation

Fifteen of naturally wavy Caucasian hair strands were prepared, with 5.0 g weight and 25 cm long each. All hair strands underwent a standardized pre-cleaning process using a 10% Sodium Lauryl Ether Sulfate (SLES) solution for 1 minute of running water rinse procedure.

3.2 Treatment protocol

The whole protocol was carried out under controlled environment, with constant 22 ± 2°C temperature and 55 ± 5% relative umidity during the treatment period.

- The water used in the wash activity was at a 35-40 °C temperature;
- Hair strands underwent a 20 min soaking and then the water excess was removed;
- 1.0 mL of the 10% SLES solution was applied on each strand, and massaged for 60 seconds. Hair strands were rinsed for 30 seconds and then the water excess was removed. This process was consecutively performed twice;
- 0.5 mL of the test product was applied on each strand, and massaged for 60 seconds. Hair strands were naturally dried (without combing nor brushing) for 24 hours, with no washing;
- Digital images were obtained from every hair strand immediately after the test products application, and then after 24 hours of treatment.

3.3 Images analyses

Original images, all of them with a 6.0 *Mpixels* resolution, were converted into a grey scale using the software Scion® Image for Windows (ScionCorp). From these converted images, software analyses were performed for determining both strands definition and frizz reduction.

RESULTS

Figure 2 below shows original images of hair strands 24 hours after each treatment application.

Figure 2. Hair strands images of each treatment group: PLACEBO, PEQUI OIL at 1.5% and PEQUI OIL at 3.0%.

1. Curls definition

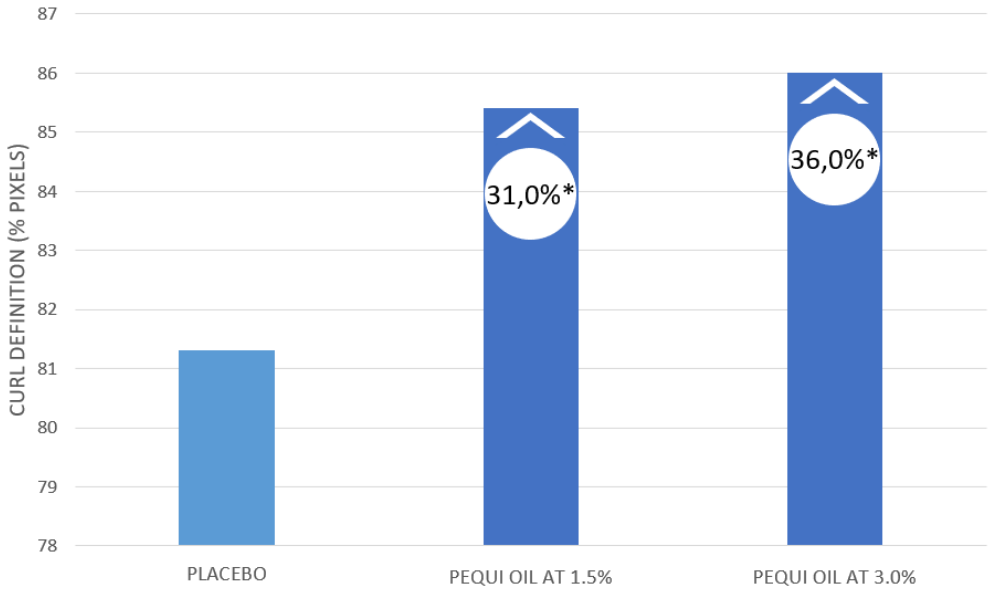
The parameter "Curls definition" (CD) was determined as a function of frizz and hair strand volume results, as per Equation 1.

$$CD\ (\%) = 100 - Frizz - Volume$$

Equation 1. Calculus of the parameter "Curls Definition" (CD) from values given by frizz and volume analysis.

Frizz is defined as the percentage of black pixels areas formed by loosen threads from the strand body, obtained by the digital image after binarization (conversion into black/white). The volume is defined as the percentage of the black pixels area of the strtand body, obtained from the digital image after its binarization.

Graph 1 shows calculated CD values.



* Statistical significance p<0.05 compared to PLACEBO.

Graph 1. CD values for treatment groups with PEQUI OIL at 1.5% and 3.0% compared to PLACEBO.

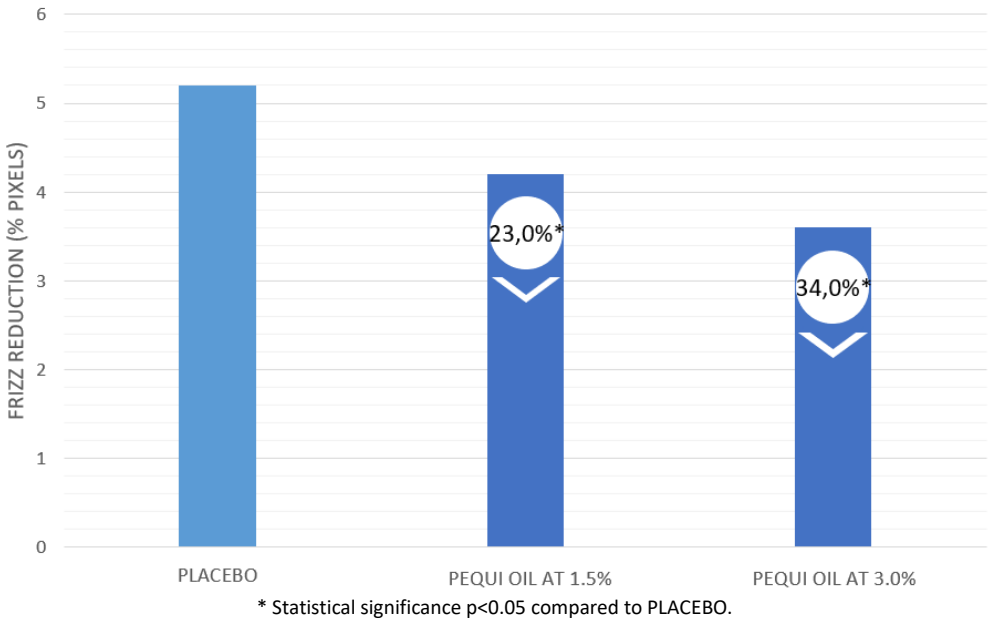
CD final data obtained for PEQUI OIL at 1.5% and 3.0% treatments were statistically analyzed in a comparison with the PLACEBO group, using the only factor variance analysis method, with Dunnett's multiple comparison post-test, considering a 95% confidence interval.

Thus, according to results obtained, hair strands undergone PEQUI OIL at 1.5% and 3.0% treatments presented significantly greater improvement in their curl definition when compared to the PLACEBO group.

CD final values obtained for treatment groups containing PEQUI OIL at 1.5% and 3.0% were compared to each other and did not reach any statistically significant differece.

2. Frizz reduction

Graph 2 shows results of the frizz reduction.



Graph 2. "Frizz reduction" values of treatment groups with PEQUI OIL at 1.5% and 3.0% compared to PLACEBO.

"Frizz reduction" final values obtained by PEQUI OIL at 1.5% and 3.0% were statistically compared to final values reached by the PLACEBO group, using the only factor variance analysis method, with Dunnett's multiple comparison post-test, considering a 95% confidence interval.

After 24 hours in controlled environment, hair strands underwent treatments with PEQUI OIL at 1.5% and 3.0% showed significantly lower results when compared to the PLACEBO treatment.

"Frizz reduction" final values obtained by PEQUI OIL at 1.5% and 3.0% were statistically compared to each other and did not show any statistically significant difference.

CONCLUSION

In terms of curls definition, hair strands undergone the PEQUI OIL at 1.5% treatment presented 31% greater curls than the PLACEBO group hair strands. However, hair strands undergone PEQUI OIL at 3.0% treatment showed a 36% greater curls definition when compared TO PLACEBO group hair strands.

In terms of frizz reduction, hair strands undergone the PEQUI OIL at 1.5% treatment showed a 23% greater frizz reduction when compared to the PLACEBO group hair strands, while hair strands undergone the PEQUI OIL at 3.0% showed a 34% greater frizz reduction when compared to PLACEBO group hair strands.

In both evaluations, results of treatments groups with PEQUI OIL at 1.5% and PEQUI OIL at 3.0% where compared to each other, but they did not present any significant statistical difference.

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